

WHAT IS CLAIMED IS:

1. A process for producing a semiconductor device, comprising:  
forming a first semiconductor film having an amorphous structure;  
adding an element for promoting crystallization to the first semiconductor film having the amorphous structure;  
conducting a first heat treatment to form a first semiconductor film having a crystal structure;  
forming a second semiconductor film containing a rare gas element over the first semiconductor film having the crystal structure;  
conducting a second heat treatment to segregate the element for promoting crystallization into the second semiconductor film;  
and removing the second semiconductor film.
2. A process according to claim 1, wherein the second semiconductor film is formed by sputtering.
3. A process according to claim 1, wherein the second semiconductor film is formed by plasma CVD.
4. A process according to claim 1, wherein the first heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.
5. A process according to claim 1, wherein the first heat treatment is conducted by furnace annealing using an electrical heating furnace.

6. A process according to claim 1, wherein the second heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

7. A process according to claim 1, wherein the second heat treatment is conducted by furnace annealing using an electrical heating furnace.

8. A process according to claim 1, wherein the rare gas element is one or more selected from He, Ne, Ar, Kr and Xe.

9. A process according to claim 1, wherein the element for promoting crystallization is one or more selected from Fe, Ni, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au.

10. A process for producing a semiconductor device, comprising:  
forming a first semiconductor film having an amorphous structure;  
adding an element for promoting crystallization to the first semiconductor film having the amorphous structure;  
conducting a first heat treatment to form a first semiconductor film having a crystal structure;  
forming a barrier layer over a surface of the first semiconductor film having the amorphous structure;  
forming a second semiconductor film containing a rare gas element over the barrier layer,  
conducting a second heat treatment to segregate the element for promoting crystallization into the second semiconductor film, and

removing the second semiconductor film.

11. A process according to claim 10, wherein the second semiconductor film is formed by sputtering.

12. A process according to claim 10, wherein the second semiconductor film is formed by plasma CVD.

13. A process according to claim 10, wherein the barrier layer comprises a chemical oxide film formed using ozone water.

14. A process according to claim 10, wherein the barrier layer is formed by oxidizing the surface of the first semiconductor film having the amorphous structure by plasma treatment.

15. A process according to claim 10, wherein the barrier layer is formed by oxidizing the surface of the first semiconductor film having the amorphous structure with ozone generated by radiation of ultraviolet rays in an atmosphere containing oxygen.

16. A process according to claim 10, wherein the first heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

17. A process according to claim 10, wherein the first heat treatment is conducted by furnace annealing using an electrical heating furnace.

18. A process according to claim 10, wherein the second heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

19. A process according to claim 10, wherein the second heat treatment is conducted by furnace annealing using an electrical heating furnace.

20. A process according to claim 10, wherein the rare gas element is one or more selected from He, Ne, Ar, Kr and Xe.

21. A process according to claim 10, wherein the element for promoting crystallization is one or more selected from Fe, Ni, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au.

22. A process for producing a semiconductor device, comprising:

- forming a first semiconductor film having an amorphous structure;
- adding an element for promoting crystallization to the first semiconductor film having the amorphous structure;
- conducting a first heat treatment to form a first semiconductor film having a crystal structure;
- forming a second semiconductor film over the first semiconductor film having the crystal structure;
- adding a rare gas element to the second semiconductor film;
- conducting a second heat treatment to segregate the element for promoting crystallization into the second semiconductor film, and

removing the second semiconductor film.

23. A process according to claim 22, wherein the rare gas element is added by ion implantation or ion doping.

24. A process according to claim 22, wherein the first heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

25. A process according to claim 22, wherein the first heat treatment is conducted by furnace annealing using an electrical heating furnace.

26. A process according to claim 22, wherein the second heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

27. A process according to claim 22, wherein the second heat treatment is conducted by furnace annealing using an electrical heating furnace.

28. A process according to claim 22, wherein the rare gas element is one or more selected from He, Ne, Ar, Kr and Xe.

29. A process according to claim 22, wherein the element for promoting crystallization is one or more selected from Fe, Ni, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au.

30. A process for producing a semiconductor device, comprising:

- forming a first semiconductor film having an amorphous structure;
- adding an element for promoting crystallization to the first semiconductor film having the amorphous structure;
- conducting a first heat treatment to form a first semiconductor film having a crystal structure;
- forming a barrier layer over a surface of the first semiconductor film having the amorphous structure;
- forming a second semiconductor film over the barrier layer;
- adding a rare gas element to the second semiconductor film;
- conducting a second heat treatment to segregate the element for promoting crystallization into the second semiconductor film; and
- removing the second semiconductor film.

31. A process according to claim 30, wherein the rare gas element is added by ion implantation or ion doping.

32. A process according to claim 30, wherein the barrier layer comprises a chemical oxide film formed using ozone water.

33. A process according to claim 30, wherein the barrier layer is formed by oxidizing the surface of the first semiconductor film having the amorphous structure by plasma treatment.

34. A process according to claim 30, wherein the barrier layer is formed by oxidizing the surface of the first semiconductor film having the amorphous structure with ozone generated by radiation of ultraviolet rays in an atmosphere containing oxygen.

35. A process according to claim 30, wherein the first heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

36. A process according to claim 30, wherein the first heat treatment is conducted by furnace annealing using an electrical heating furnace.

37. A process according to claim 30, wherein the second heat treatment is conducted by radiation from one or more selected from a halogen lamp, a metal halide lamp, a xenon arc lamp, a carbon arc lamp, a high-pressure sodium lamp, or a high-pressure mercury lamp.

38. A process according to claim 30, wherein the second heat treatment is conducted by furnace annealing using an electrical heating furnace.

39. A process according to claim 30, wherein the rare gas element is one or more selected from He, Ne, Ar, Kr and Xe.

40. A process according to claim 30, wherein the element for promoting crystallization is one or more selected from Fe, Ni, Co, Ru, Rh, Pd, Os, Ir, Pt, Cu and Au.